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Tracy Irani

Janas Sinclair

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Differing viewpoints about labeling of genetically modified (GM) foods have created communication challenges. This experiment, using a college student sample, examined the impact of exposure to various types of GM food labels on perceptions of the accountability of government and industry as well as attitude toward GM foods. Results indicated that labeling message and salience (strength) affected subjects' perceptions of government and industry accountability, which in turn affected attitude toward purchase as well as global attitudes toward GM foods. Results indicated that subjects perceived a stronger prescription-event accountability linkage when (1) the label indicating the presence of GM ingredients had strong salience and (2) when the label indicating lack of GM ingredients had weak salience. The findings showed the manufacturer's product claim label created stronger accountability perceptions that industry is concerned with regulating GM foods than the mandatory FDA certified label. A key implication of the study is that communicating to consumers about governmental and industry efforts related to GM foods may be an effective way to achieve greater consumer support of controversial food technologies.

Introduction and Theoretical Framework

Major developments in plant genetic engineering over the past several years have created both opportunity and controversy for U.S. agriculture. On the one hand, genetically modified crops have the potential to alter traditional crop agriculture systems and provide benefits for both producers and consumers. Yet, challenges to their development and marketing and perceptions of safety risks have steadily increased in Europe, Asia, and the United States (Beachy, 1999; Shanahan, Scheufele, & Lee, 2001). Agricultural communicators have been at the forefront of the biotechnology debate, whether working as information specialists at universities where much of the initial research and development work on transgenics has taken place, serving as spokespersons for the companies involved in producing genetically

modified food products, or developing communications for commodity associations whose members themselves may disagree on the role of genetically modified crop varieties.

In the United States, conflicting consumer viewpoints on biotechnology are further complicated by a relative lack of awareness about GM food products and their availability. For instance, it has been estimated that 70% of all foods sold in supermarkets contain at least one genetically engineered ingredient. Yet opinion polls indicate that the vast majority of Americans are not aware that their food may contain genetically engineered ingredients (Doerfert, Akers, Haygood, & Kistler, 2003). This situation has led to a contentious debate between advocates and opponents over the labeling of GM food products (Pew Initiative on Food and Biotechnology, 2002), much of which has been played out in the media, leading to communication challenges for agricultural communicators. As Doerfert et al. put it, "Even the heart of the debate is under debate" (p. 272).

While some argue that the GM food labeling issue centers on giving consumers choice and fair protection from potential food safety risk, others argue that it would create a new and unnecessary precedent not warranted by what the science says about the potential risk involved. Those who support the labeling of GM foods argue that consumer choice is an important antecedent to public trust in the safety of biotechnology-derived products. Opponents, however, suggest that any mandatory labeling of biotechnology-derived foods might cause consumers to perceive the label as a potential warning, implying that these foods are undesirable and perhaps risky for consumption (Hoban, 2000).

This distinction between product labeling as providing information versus a warning may indeed be a significant communication issue that could exert subtle influence on consumers' perceptions and attitudes about GM food products. Some indirect research evidence supports the claim of labeling advocates that product labels provide consumers with a choice, which may be related to public perceptions of risk and trust in the safety of food products. Frewer, Howard, and Shepherd (1996), among others, have contended that individuals who perceive that they lack the choice as to whether to expose themselves to a risk come to perceive the risk as more threatening. In a study of consumer risk perceptions and labeling of rBST milk, Zepeda & Douthitt (1991) found that being subjected to rBST involuntarily and perceiving no consumer benefits increased consumers' risk perceptions; however, the presence of labeling served to mitigate consumer outrage and negative perceptions.

Studies have shown that 57% of U.S. consumers have said they would be "less likely to buy" a product with a GM food label (Phillips & Foster, 2000). Further complicating the situation, some food manufacturing companies have begun to voluntarily label their products as "GM free," using these presumed avoidance claims as an implied superiority strategy targeted to consumers concerned about potential food safety and environmental risks of GM foods (Stull, 2000).

The impact of GM food product labels may also depend on the salience, or strength, of the message. Research on the effects of warning labels for alcoholic beverages and other hazardous consumer products indicates that stronger or more severe messages result in greater recall (Smith, 1990) and increased perceptions of product hazard (Jarrad, Simpson, & Wogalter, 1994). In a review of the effects of warning messages, Stewart and Martin (2000) recommend empirical testing to examine intended and unintended effects of messages designed to be salient to consumers.

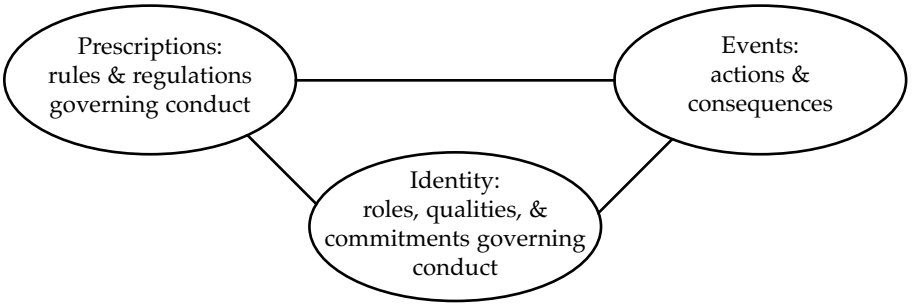
GM Food Labeling and Accountability Perceptions

Effective agricultural communication depends on understanding the reasons consumers may respond positively or negatively to a message such as a product label. Research has shown that consumers attend to, recall, and act upon product warnings (Hankin et al., 1993). However, research is lacking on the direct effects of such labels on consumer decision making (Lehto & Miller, 1986). One way labels may influence consumers' attitudes toward GM foods is through the construct of public accountability. Accountability has been defined by researchers as being answerable to audiences for fulfilling obligations, duties, and expectations (Schlenker, Britt, Pennington, Murphy, & Doherty, 1994; Schlenker & Weigold, 1989; Schlenker, Weigold, & Doherty, 1991). When individuals, groups, and companies are held accountable for their actions, citizens can trust that those individuals and groups will follow society's rules. If the rules are broken, the offenders will be appropriately sanctioned.

Accountability is comprised of perceptions of the relationships between three elements: prescriptions, events, and identity. These elements must be defined for any given communication situation. ***Prescriptions*** are rules and regulations for conduct, such as rules for developing GM food products. ***Events*** are actions, such as the introduction of the GM product, and the consequences of those actions. ***Identity*** refers to the roles, qualities, and commitments that the audience associates with an actor. In the case of GM food labeling, the biotech industry and the government agency that regulates it, the Food and Drug Administration (FDA), are relevant actors. Consumers'

perceptions of accountability are assessed in terms of the linkages between these three elements and the degree to which the relevant actors are individually or collectively associated with them. (See Figure 1.)

Figure 1. Triangle Model of Accountability



The ***prescription-event link*** refers to the extent to which rules clearly apply to a given situation, such as the degree to which FDA product labeling regulations are perceived to clearly apply to genetically modified food products and the companies that develop them. The ***prescription-identity link*** refers to perceptions that rules apply to a given agent because of the qualities, or identity, of the entity. The ***identity-event link*** refers to the extent to which the entity is perceived to be connected to the event and in control of the consequences.

Accountability is strong when the links between each of these three elements are perceived to be strong and weak when the links are perceived to be weak. When the links between prescriptions, events, and identity are strong, then consumers would be expected to judge industry and government as accountable (Schlenker et al., 1994; Schlenker & Weigold, 1989; Schlenker, Weigold, & Doherty, 1991). Judgments of accountability should also influence consumers' perceptions and evaluations of risk. Consumers who perceive strong accountability linkages should also have faith that government and industry will act to minimize any potential risks to the general public.

Purpose and Objectives

The purpose of this study was to examine how GM food product label characteristics affected subjects' perceptions of the accountability of government and industry agents and to determine the influence of accountability perceptions on attitudes toward GM foods. To conduct the study, subjects were exposed to one of a set of three GM food label conditions designed to

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indicate whether or not GM ingredients were present, whether the label was officially sanctioned by the FDA or was a voluntary manufacturer's product claim, and whether the label conveyed strong or weak message salience. The research questions were:

(1) What effect does exposure to each of the message condition sets have on subjects' perceptions of the accountability of either the manufacturer or government regulator (specifically the FDA)?

(2) What effect do subjects' perception of accountability have on their attitudes toward purchasing the actual product and their global attitudes toward GM foods?

Method

The research design looks at the effects of three specific labeling message conditions (GM ingredients: present or absent) X (type of label: official FDA or voluntary manufacturer's product claim) X (message salience: strong or weak) on subjects' perceptions of accountability and attitudes toward GM food. Subjects (N = 342) were students at three public U.S. universities – University of Florida, Florida International University, and Kansas State University. The study was conducted in sessions of about 20 subjects randomly assigned to treatment conditions.

A soy-based power bar was selected as the stimulus product. Biotech labeling is relevant for this product category, because power bars contain soybeans, most of which are currently grown from genetically modified crop varieties. Further, some power bar manufacturers have begun to voluntarily place "GM free" labels on their packaging.

Subjects first viewed a computer screen that displayed both the front and back of one of the power bar packages. The front of the package depicted the brand name and graphics from the package of an actual soy-based power bar. The back of the package featured the product's nutrition label.

Product labeling conditions were as follows:

Presence or absence of GM ingredients. Labeling information in the nutrition facts area of the power bar product label was manipulated to communicate that the bar either did or did not contain GM ingredients.

Type of label. Two types of product label were tested. In the first, the text indicated that the product was certified by the FDA. In the second, the text information was manipulated to appear to be a manufacturer's voluntary product claim indicating the presence or absence of GM ingredients.

Message salience. In the strong salience condition, an additional statement was added to the front of the package: "This product may contain

genetically modified ingredients, as defined by the U.S. Food and Drug Administration." In the non-GM condition, the label on the front of the package stated, "This product contains no genetically modified ingredients, as defined by the U.S. Food and Drug Administration." In the weak message condition, the label on the front stated that it "contains soybean protein wrapped in chocolate" as on the original product packaging.

Perceptions of accountability. Perceptions of accountability were measured with three accountability linkages: prescription-event, prescription-identity, and identity-event. Based on Schlenker's model, Likert scale items were created to assess each of these linkages as applied to consumer perceptions of GM foods. Six items assessed each linkage. For the prescription-event link, all six items dealt with respondents' belief that there are government prescriptions, or rules, that specifically apply to labeling of GM foods. The prescription-identity and identity-event links were measured in two dimensions: identity with the FDA and the biotech food industry. All the accountability items were measured on seven-point Likert scales, and the items measuring each link were averaged.

Attitudes toward purchase and global attitudes toward GM foods. Attitude toward purchase was measured by asking subjects if they thought purchasing the product would be good/bad, foolish/wise, and beneficial/harmful (Mitchell, 1986). Global attitude toward GM foods was measured in terms of perceptions of six potential applications of this technology: reducing need for pesticides, improving nutritional content of food, improving the taste of food, making food last longer, increasing crop yield, and solving problems related to overpopulation in developing countries. For each application, respondents indicated their agreement or disagreement with statements that the application was (1) useful for society, (2) risky for society (reverse scored), (3) morally acceptable, and (4) should be supported (Gaskell et al., 1999). All items were averaged to create a single scale.

Finally, two items served as a manipulation check. First, subjects identified the statement on the front of the package from a list that included the three statements actually used and three distracters including "none of the above." Second, subjects identified the statement on the nutrition label from a list that included the four statements actually used and "none of the above."

Findings

Analysis of the manipulation check indicated the correct statements were most commonly selected in every condition for the front of the package

(x^2 (63) = 445.53, $p < .0001$) and the nutrition label (x^2 (49) = 326.48, $p < .0001$). Results showed that the mean for the prescription-identity (government) link was significantly greater than the prescription-identity (industry) link (t (1, 338) = 6.74, $p < .0001$), and the mean for the identity-event (industry) link was greater than the identity-event (government) link (t (1, 338) = 4.12, $p < .0001$). When the product was identified as containing GM ingredients, attitude toward purchase was significantly lower than when the product was labeled GM-free (t (1, 338) = 2.36, $p < .02$). Attitude toward purchasing the product when it contained GM ingredients was significantly lower than global attitudes. Table 1 presents descriptive statistics for all scaled variables.

Table 1. *Descriptive Statistics for the Scale Variables*

Variable	*M*	*SD*	*Standardized alpha*
Accountability links			
Prescription-event	4.42	1.09	.86
Prescription-identity (FDA)	4.81	1.15	.77
Prescription-identity (industry)	4.32	1.24	.73
Identity-event (FDA)	4.83	1.20	.68
Identity-event (industry)	5.11	1.21	.62
Attitude toward Purchase	4.14	1.36	.83
GM condition	3.98	1.39	
Non-GM condition	4.32	1.31	
Global Attitude	5.07	1.04	.94

All items based on seven-point scale, with 1= least favorable term and 7 = most favorable term

Analysis of variance (ANOVA) was used to analyze the effect of labeling on each of the accountability links: prescription-event, prescription-identity (government), prescription-identity (industry), identity-event (government), and identity-event (industry). In each ANOVA model, the independent variables were GM ingredients (present or absent), type of label (FDA/manufacturer claim), and message salience (strong or weak).

There was one significant effect with the prescription-event link and that was the interaction between GM ingredients and message salience. See Table 2.

Table 2. *Effect of Labeling Message Conditions on Prescription-Event Accountability Link*

Message Conditions	*F*	*df*	*Sig.*
GM Ingredients x Message Salience	7.98	1,332	.005
*GM Ingredients absent	4.55	1, 332	.03
*GM Ingredients present	3.45	1, 332	.06

*Indicates simple main effects.

As Table 2 shows, analysis of the simple main effect of message salience indicated that when GM ingredients were absent, there was a significant message salience effect $F(1, 332)$, $p < .03$, indicating that the weak message increased perceptions that there are rules that apply to GM foods relative to the strong message. When GM ingredients were present, the message salience effect was near-significant, $F(1, 332)$, $p < .06$. Table 3 presents the means for the sub-samples of subjects in the GM ingredients x message salience conditions.

Table 3. *Perceptions of the Prescription-Event Link by GM Ingredients by Message Salience.*

	Strong Message Salience			Weak Message Salience		
GM Ingredients	*M*	*SD*	*n*	*M*	*SD*	*n*
GM Ingredients absent	4.24	.99	80	4.60	.99	81
GM Ingredients present	4.56	1.23	86	4.28	1.10	93

There was one significant effect for the prescription-identity link when identified with industry, type of label (F (1, 331) = 4.14, $p < .04$). The manufacturer's product claim label created stronger perceptions that industry is concerned with regulating GM foods ($M = 4.44$, $SD = 1.25$, $n = 179$) than the mandatory FDA-certified label ($M = 4.17$, $SD = 1.23$, $n = 160$).

There were no significant effects at alpha of .05 for the prescription-identity link when identified with the mandatory FDA label, which assessed perceptions that the FDA is concerned with regulating GM food labels. In this case, subjects may have perceived labeling by the FDA as a required and routine task, thus not relating this to any sense of commitment on the government's part.

There were two significant effects for the identity-event link when identified with industry, the main effect of GM ingredients and the main effect of type of label. See Table 4.

Table 4. *Effect of Message Labeling Conditions on Identity-Event Link.*

Message conditions	*F*	*df*	*Sig.*
GM Ingredients (present/absent)	5.93	1, 331	.02
Type of label (FDA/manufacturer claim)	4.25	1, 331	.04

Results indicated that subjects perceived that a particular company would be more connected with the effects of GM foods when the stimulus product contained GM ingredients than when it did not. When subjects were exposed to the official FDA label rather than the manufacturer's product claim label, it was also perceived that a particular company would be more connected with the effects of GM foods. See Table 5.

Table 5. *Perceptions of the Identity-Event Link by GM Ingredients by Type of Label*

Message conditions	*M*	*SD*	*N*
GM Ingredient present	5.25	1.23	178
GM Ingredients absent	4.95	1.16	161
FDA label	5.25	1.17	160
Manufacturer's label	4.98	1.22	179

There was only one significant effect for the identity-event link when identified with the FDA label, the main effect of message salience (F (1, 332) = 4.17, $p < .04$). When the message was strong ($M = 4.97$, $SD = 1.17$, $n = 166$), results showed that subjects perceived that the FDA would be more connected to the effects of GM foods than when the message was weak ($M = 4.69$, $SD = 1.22$, $n = 174$).

The second stage of analysis explored the relative effects of the accountability links on attitudes about purchasing GM food, as well as global attitudes. Separate regression models were run for these two measures. In both models, the independent variables were the five measures of the accountability links: prescription-event, prescription-identity (government), prescription-identity (industry), identity-event (government), and identity-event (industry). Results showed that both the prescription-event and prescription-identity (industry) links correlated significantly with global attitudes toward GM foods. Attitudes toward GM foods became more favorable as perceptions that the industry is concerned with regulation of food labels increased. The prescription-event link, on the other hand, correlated negatively with attitudes toward GM foods. Attitudes became less favorable as

perceptions that there are rules that apply to product labels of GM foods increased. See Table 6.

Table 6. *Summary of Regression Model Analysis Predicting Global Attitude Toward GM Foods*

Measure and Variable	*B*	*SE B*	*ß*
Global attitude toward plant biotechnology (R^2 = .08, p < .0001)			
Prescription-event	-.12	.06	-.14
Prescription-identity (government/FDA)	.08	.06	.09 ns
Prescription-identity (industry)	.20	.05	.24
Identity-event (government/FDA)	.007	.05	.008 ns
Identity-event (industry)	09	.05	.11 ns

Only the prescription-identity (industry) link had a significant effect on attitude toward purchasing the product in the study. Attitude toward purchase became more favorable as perceptions that the industry is concerned with regulation increased. However, this model predicted only 2% of the variance and was not significant at alpha of .05.

Discussion

The results of this study provide support for the argument that GM food message labeling conditions can influence perceptions of accountability and that these perceptions, in turn, exert some influence on subjects' attitudes toward GM foods. In general, the means for the accountability linkages themselves were fairly high. The means varied depending on government/FDA or industry identity. Further, when the product was identified as containing GM ingredients, attitude toward purchase was significantly lower than when the product was labeled GM-free, and attitude toward purchasing the product when it contained GM ingredients was also significantly lower than global attitudes.

A limitation of this study's findings is the use of college undergraduates as subjects. Although subjects' overall knowledge and attitude toward GM foods were consistent with results reported in the literature, results of this study cannot be generalized to a wider population.

Subjects appeared to perceive a stronger prescription-event linkage when the GM ingredient-present messages had strong salience and when GM ingredient-absent messages had weak salience. Strong GM

ingredient-absent messages and weak GM ingredient-present messages, however, seemed to foster less favorable perceptions of the prescription-event link, perhaps because of their lack of congruence. Findings showed that the manufacturer's product claim label may have created stronger perceptions that industry is concerned with regulating GM foods than the mandatory FDA certified label. It could be inferred from this result that the action of a company to freely label its products as to GM content was interpreted by subjects as indicative of concern about protecting the public interest with regard to GM food, which is the general intention of regulation, or prescriptions. Mandatory FDA labeling, however, would not be expected to have the corresponding positive effect for perceptions that the government is committed to GM regulation. Voluntary labeling by the manufacturer may convey that the industry is going above and beyond what is required, and therefore this type of label may indicate a strong prescription-identity link. Mandatory FDA labeling, on the other hand, may simply be seen as a required duty, or part of the FDA's job, and therefore such labels may not be seen as a particularly strong indication of commitment to regulation.

Results of the study also showed that presence or absence of GM ingredients, as well as type of label, affected the identity-event link with regard to industry. The presence or absence of GM ingredients would be expected to affect the identity-event link, because when the product is labeled as GM food, the brand and company that produce it are automatically publicly linked – making it clear who would be responsible for the impact of this particular GM food. Similarly, exposure to the mandatory FDA label would be expected to lead to perceptions of a stronger identity-event link than a manufacturer's claim-type label.

Multiple linear regression showed that both the prescription-event and prescription-identity links correlated significantly with global attitudes toward GM foods. Attitudes toward GM foods became more favorable as perceptions that the industry is concerned with regulation of food labels increased, while, for the prescription-event link, attitudes became less favorable as perceptions that there are rules that apply to product labels of GM foods increased. While seemingly contradictory, this finding may suggest that while consumers do perceive industry concern with regulation favorably, exposure to a GM food label may also stimulate a product warning label type response, implying that these foods may not be safe.

Here again, the perception may be triggered by the salience or "non-routineness " of the event, an implication that would suggest there is merit in agricultural communicators focusing more efforts on communicating

about the rules and regulations associated with development of GM foods, as opposed to concentrating solely on potential perceived benefits or risks.

It follows, then, that efforts to inform the public about the specific rules associated with product food labeling regulation are worthy of consideration. Based on the finding that both global attitude and attitude toward purchase became more favorable as perceptions that industry is concerned with regulation increased, the implication is that labeling, as a function of governmental regulation, could actually serve to enhance consumers' perceptions of the accountability of government and industry agents involved in a food technology such as biotech.

For agricultural communicators, this may provide a new avenue to pursue when attempting to communicate scientifically objective and balanced information about a controversial food technology. Communicating to consumers about the commitment to regulation and the communication of governmental and industry efforts in this area may be a way to achieve consumer support.

Keywords

genetically modified food, labeling, accountability, consumer behavior.

About the Authors

Tracy Irani is an assistant professor in the Department of Agricultural Education and Communication at the University of Florida, Gainesville. She is a member of ACE and her e-mail address is irani@ufl.edu. Janas Sinclair is an assistant professor in the Department of Advertising and Public Relations, Florida International University, North Miami. This paper was presented at the annual meeting of the Association for Education in Journalism and Mass Communication (AEJMC), Miami, FL, 2002.

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